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Technical Report

AD 640 126

MECHANIZATION STUDY
OF THE TECHNICAL LIBRARY
U. S. NAVAL AVIONICS FACILITY,
INDIANAPOLIS, INDIANA

Submitted to

Defense Supply Agency
Defense Documentation Center
Cameron Station, Virginia

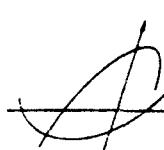
by

Booz, Allen Applied Research Inc.
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Bethesda, Maryland 20014

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ABSTRACT

The Naval Avionics Facility, Indianapolis (NAFI) Technical Library is planning a mechanized system to produce a permuted index of pertinent periodical references and proceedings, with books and documents to be added later. Input to the system is punched paper tape prepared from the source material, and the primary program is a "canned" General Electric permuted index program for NAFI's GE 225 computer. NAFI's Burroughs 280 computer is used to obtain special listings of EAM card information. The Library feels that the permuted index system is a relatively simple and inexpensive way to mechanize Library files.

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I. SUMMARY

A mechanized system is being planned at the Naval Avionics Facility, Indianapolis (NAFI) Technical Library to produce a permuted index of pertinent periodical references and proceedings holdings. (Books and documents will be added later.) The system is designed for NAFI's General Electric 225 and Burroughs 280 computers. Input to the system is punched paper tape prepared from the source material, and the primary program is a "canned" General Electric permuted index program for the 225 computer.

The Technical Library serves needs of all NAFI departments including about 400 engineers and scientists and about 200 supporting technical personnel. The Library's collection consists of about 7,000 books, 450 periodical titles, 20,000 specifications and standards, about 25,000 technical reports, and a number of symposia and conference proceedings. The annual acquisition rate of this collection is 550 book volumes, 6,000 periodical issues, and 5,000 technical reports. An average of 13 books, 1 pamphlet, 50 specifications, 28 periodicals, 10 catalogs, and 10 technical reports are circulated daily, a total of 144 items. The Library collects in all major areas of science and technology, with emphasis on the following fields: aeronautics; mathematical sciences; materials; space technology;

chemistry; earth science; ordnance; electronics; missile technology; methods and equipment; navigation, communication, countermeasure; atmospheric sciences; military sciences; and physics and optics.

The Library also has a vendor's catalog file on microfilm system called the Visual Search Microfilm File (VSMF). This consists of a file of film cartridges and a reader unit. Locations on the film are coded with visual markings that are apparent during the scanning of the cartridge.

Books are cataloged by using Library of Congress cards when these are available. Otherwise, they are cataloged in house, and cards are prepared by typing on multilith mats for reproduction. The old National Bureau of Standards (NBS) classification scheme is used, with expansions by the Library. The subject authority file is locally assembled from the Applied Science and Technology Index, Clearing House for Scientific and Technical Information (CFSTI), NASA Scientific and Technical Aerospace Reports (STAR), DDC Thesaurus, the Sharp list, and AEC headings, plus additions by the Library.

When periodicals are received, they are immediately scanned by the librarian for items of current interest for the "current awareness" file. This file consists of indexed reference cards of the

state-of-the-art in the subjects with which NAFI is concerned at a given time. Some of these subjects are: thin film technology, vacuum technology, reliability, cost effectiveness, PERT, video mapping, microelectronics, electronic circuitry, value engineering, management-administration, soldering techniques, and machineability.

When the Librarian identifies a periodical item of interest, she inserts a blank card in the location. Following the day's perusal (about a one-hour activity), the Librarian sends the resulting stack of periodicals with marker cards to a typist. The typist prepares a reference card for each item, indicating the title of the article and the source. The cards are then returned to the Librarian who, after recognizing the subject of each card from the article's title, sorts and files the cards by subject. There are currently between 5,000 and 10,000 cards in this system representing both active and discontinued areas of interest.

Most reference requests by users are for specific information. Searches are done manually, and a record is kept of the results to preclude repeating the effort for a similar request at a later date.

The Library also distributes monthly a two-page document accessions list. An informal SDI system, based upon the Librarian's

knowledge of individual interests and projects, functions with newly received documents and periodicals.

Appendix A illustrates the organization of NAFI and of the Library within NAFI.

II. MECHANIZATION

1. CHRONOLOGY

In 1962, use of a commercially available permuted index of symposia and conference proceedings led to consideration of this approach to indexing both the Library's holdings of proceedings and the current awareness file of periodical references. As a result, a study on the subject of information retrieval in the Library was performed by the Management Engineering Staff. This study proposed two alternate systems: one referred to as "minimal," which suggested use of available EAM equipment and projected IBM 1401 equipments with punched cards as input-output, and the other utilizing the 1401 with user-operated input-output console equipped with a keyboard for queries and a cathode-ray tube for answers. However, the study was not implemented due to its estimated high cost and the shortage of data-processing personnel.

In 1963, a permuted index system using the NAFI GE-225 computer was proposed to the Library by the Numerical Mathematics Staff. A system flow was designed applying the available GE-225 and Burroughs 280 computers to producing the index and related listings for the Library. (When the Burroughs computer is provided with magnetic tape drives, the whole program will probably be

converted to this computer.) This system has not yet been implemented, although the format of the current awareness file was redesigned to be compatible with the mechanized system.

2. DESCRIPTION OF PROCESSES

Three processes are discussed in this section. Two of them, designed for an IBM 1401 computer, were proposed in the 1962 study of information retrieval in the Library. The third process, designed to use the existing computers, is that of generating the permuted index. These processes are in the planning stage ; however, only the permuted index system is being actively considered.

(1) Process I -- Technical Reports

1. Input Procedures -- Creating the File

(1) Add DDC and NAFI descriptors to existing document index cards for expanded and standardized subject cataloging.

(2) Punch EAM cards for each index card, abridged to include only the identifier code, corporate author, title, and date.

(3) Using the 1401 computer, convert the card information to magnetic tape.

(4) Create a descriptor index on EAM punched cards. Punch at least one card for each descriptor and indicate applicable documents by identifying code. This forms a cross-reference to the document index entries described in steps 2 and 3.

(5) Using the 1401 computer, convert the card information to magnetic tape.

2. Input Procedures -- Maintaining and Updating the File

(1) Index new document. If a new descriptor is necessary, prepare a worksheet descriptor card. For existing descriptors, manually add the new entry to the appropriate printed descriptor cards.

(2) Prepare worksheet document card.

(3) Punch EAM cards for document and new descriptor worksheet entries.

(4) Apply the EAM cards to the 1401 computer to update the document and the descriptor tapes.

(5) Assemble printed document cards for the record file for documents to be deleted. Mark the deletion action on the card.

(6) Assemble printed descriptor cards for documents to be deleted from the descriptor file. Mark out the deleted document.

(7) Retrieve the corresponding EAM punched cards. Code the document EAM card for deletion, apply to the 1401 to erase the entry from the document tape file, and then destroy the EAM card. Punch a new descriptor card with the deletion made and apply to the 1401 to correct the descriptor tape file. Destroy the old descriptor card.

3. Outputs

(1) Magnetic tape file of document references.

(2) Magnetic tape file of descriptor-document cross-references.

- (3) Printed index cards for each document reference.
- (4) Printed index cards for each descriptor entry listing all document cross-references.

4. Search and Retrieval Procedures

- (1) Requester selects descriptors pertinent to his problem from the DDC and/or NAFI Thesaurus.
- (2) An EAM card is punched for each descriptor indicating the selected descriptor and the requester's name.
- (3) The EAM cards are then applied to the 1401 to retrieve (in computer main memory) from the descriptor tape files of corresponding document identifying codes.
- (4) The 1401 storage of codes is then compared to the document tape file to obtain a printout of the selected document bibliographic information.
- (5) The printout is supplied to the requester, who selects desired documents which are then made available to him.

(2) Process II -- Technical Reports

1. Input Procedures

- (1) Operations are performed from remotely located control stations. A new entry or request for information is delivered to the computer by clearing the station and typing in the necessary information, e.g., a document code or a descriptor list.

(2) The keyboard entry is immediately shown on the display tube of the remote station for verification. Once verified, the entry is transmitted by pressing first a function button, which informs the computer which program to use, and then the "transmit" bar on the keyboard.

2. Output

Following computer operations with a program requiring a return of information (e.g., a request for data), the information is transmitted back to the remote station and displayed. Modifications can be made to the data immediately with the keyboard and the necessary function buttons. The returned bibliographic data can be copied by hand on a card to permit the location and check-out of the corresponding documents to the requester.

(3) Process III -- Permuted Index

Figure 1 illustrates the logic flow of the permuted index system. Two computers are used; the Burroughs 280 to obtain special listings, and the GE-225 to obtain the permuted index.

FIGURE 1
Flow Diagram of Permuted Index System

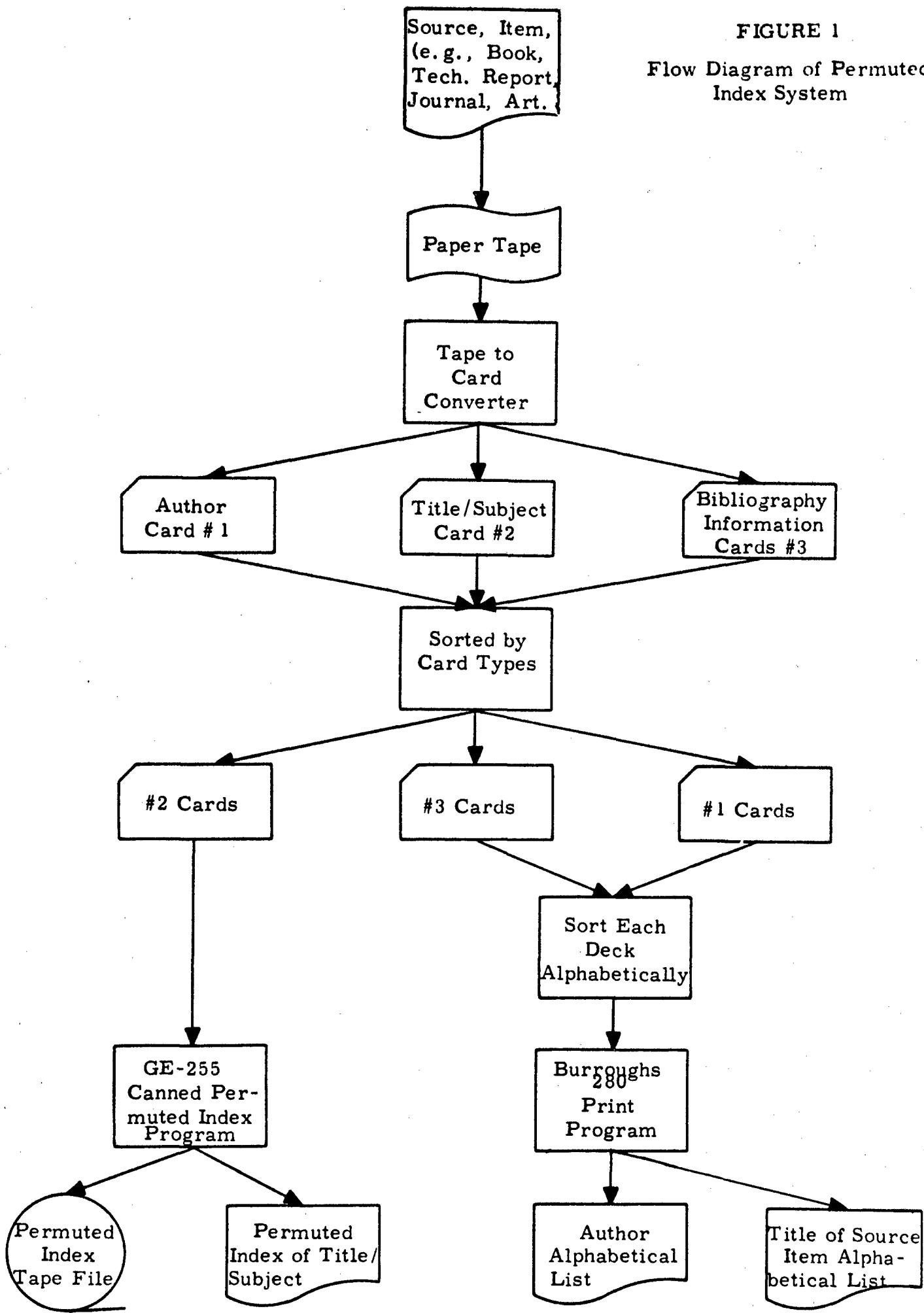
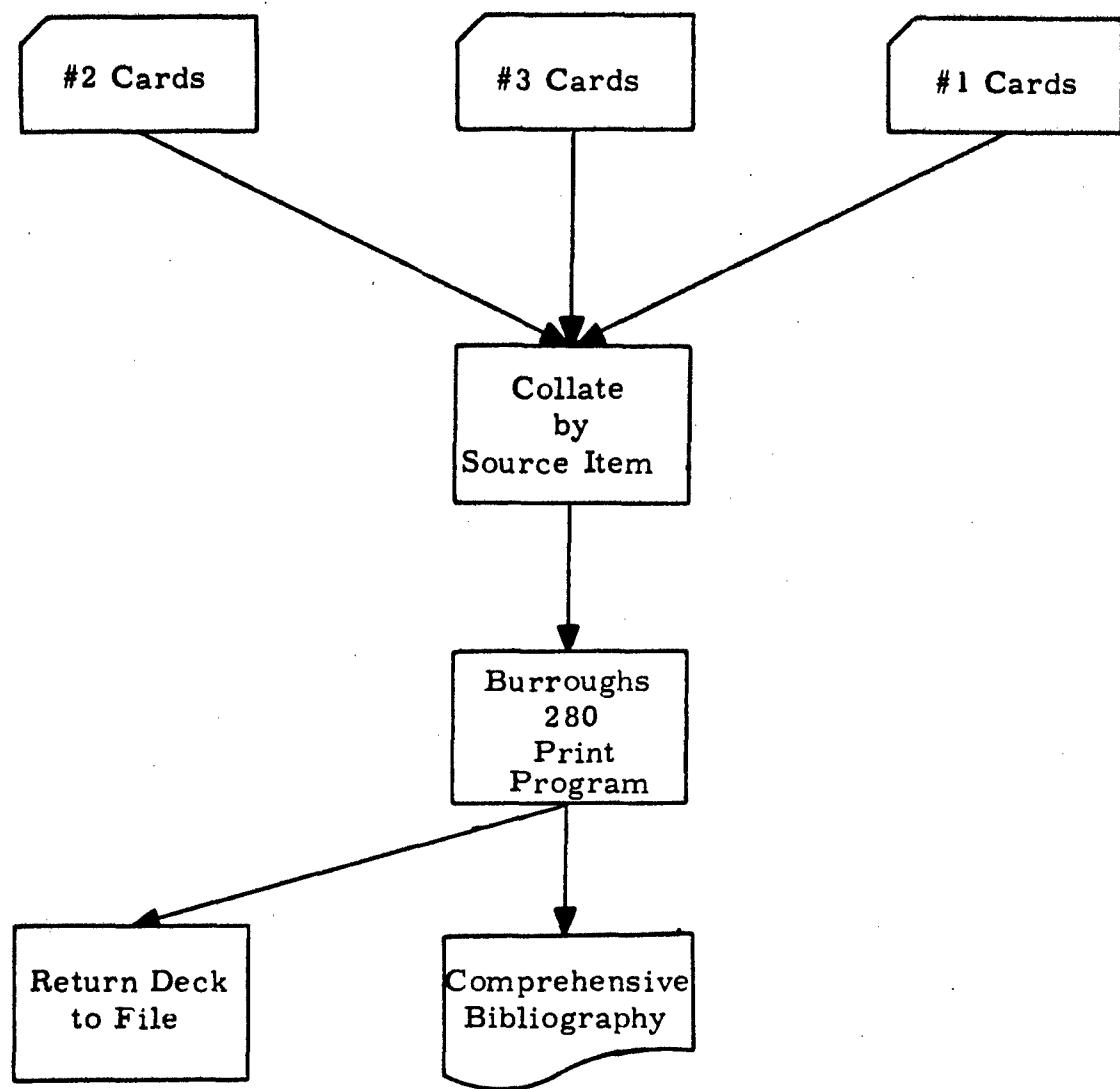


FIGURE 1 (Continued)



1. Input Procedures

(1) Using a Flexowriter, prepare a bibliographic record of each source item on a punched paper tape. A sample page copy from this operation appears in Figure 2. This record includes the source item code number, title, author, publisher, and date. If the "title does not contain sufficient information, keywords are added from the context of the item.

(2) Convert the paper tape records to cards in the following formats:

Card No. 1 -- Author Card

Columns 1-6	Item identification number
7-8	Card code
9-10	Blank
11-30	Author
31-78	Author's organization
79-80	Card sequence number

Card No. 2 -- Title/Subject Card

Columns 1-6	Item identification number
7-8	Card code
9-10	Blank
11-41	Title (If necessary, use columns 11-78 and continue on another card from column 11. A maximum of 9 continuation cards may be used. Code columns 1-10 on each card in

KS543111	MURRAY IND	BURROUGHS CORPORATION	C2
KS543121	TELEMETRY EQUIPMENTS	UTILIZING TRANSISTOR-MAGNETIC CIRCUITRY AND	C2
KS543122	HIGH-DENSITY PACKAGING.		C2
KS5431311	CONVENTION RECORD 1ST NATL CONV ON MIL ELECTRONICS	066483-87	C2
YH035411	METALWORKING		C2
MW035421	60-IPM CUTS MAKE HIGH-SPEED MILLING 65% FASTER THAN TURNING ON		C2
NC535422	SLOWER LATHES.		C2
MW0354312	METALWORKING	0664143-47	C2
KS543111	ROSENBERG JD	DIAMOND ORDNANCE FUZE LAB.	C2
KS543121	RUGGED WIDE-BAND MAGNETIC TAPE RECORDER		C2
K35431311	CONVENTION RECORD 1ST NATL CONV ON MIL ELECTRONICS	066423-29	C2
PE016711	NAGEI FJ	POLYMER PROCESSES INC	C2
FE016721	FLUIDIZED-BED PROCESS	PROTECTS COMPLEX METAL PARTS	C2
PE0167312	PRODUCTION ENGINEERING	096482-85	C2
1C525211	NASATECHBRIEF		C2
10625221	NEW LOW-LEVEL A-C AMPLIFIER	ADJUSTABLE NOISE-CANCELLATION	C2
10625222	AND AUTOMATIC TEMP COMPENSATION.	ELECTROCARDIOGRAPH BIOMEDICINE	C2
106252313	NASA TECH BRIEF 63-10003	0364NASA	C2
KS543111	KULLMAN E	ROME AIR DEVELOPMENT CENTER	C1
KS543121	OPTICAL AND ELECTRICAL RANGE INSTRUMENTATION		C1
KS5431311	CONVENTION RECORD 1ST NATL CONV ON MIL ELECTRONICS	06641-6	C1

FIGURE 2
Sample Flexowriter Copy

the same way as the first card.
Title must end on column 41
on last card.)

Column 42	Blank
43-78	Keywords (for title enrichment)
79-80	Card sequence number

Card No. 3 -- Bibliography Information Card

Columns 1-6	Item identification code
7-8	Card code
9	Sort code
10	Blank
11-68	Bibliography information-- e.g., publisher, name of journal or report
69-72	Date of publication
73-78	Total number of pages of book, or pages where article was found in periodical
79-80	Card sequence number

(3) Assemble all of the EAM cards of the desired documentation and sort by card type on an EAM card sorter.

(4) Sort the resulting author card (No. 1) deck alphabetically. Sort the bibliography card (No. 3) deck alphabetically.

- (5) Apply the author deck and the title deck to the Burroughs 280 computer to obtain various desired listings of the card information.
- (6) Apply the title card (No. 2) deck to the GE-225 computer and run with the canned permuted index program to obtain a printed permuted index and a magnetic tape file of the index.
- (7) Reassemble the three card decks with a sorter by card type.
- (8) Apply the reassembly of cards to the Burroughs 280 to obtain a comprehensive bibliography.
- (9) Return the cards to the permanent file for future operations.

2. Outputs

- (1) Comprehensive Bibliography. This list is a printout from the last input procedures step. An example is shown in Appendix B-1.
- (2) Permuted Index. This list, illustrated in Appendix B-2, is an alphabetical arrangement of each word in a title together with several of the words that appear just before and after. The latter characteristic provides each word with context. In order to prevent words of no index value from being listed, a predetermined group of words of this class (e.g., applications, work, the, to, etc.) are set in the computer program for permutation suppression.
- (3) Special listings as desired. These include alphabetical listing by author and alphabetical listing of periodicals, books, and technical reports. These lists are the result of the Burroughs 280 run.

III. EQUIPMENT, COSTS, AND EVALUATION

1. EQUIPMENT

Burroughs B-280 Computer

Central processor with 4.8K word core memory
(12-character word)
B-124 card reader/printer (800 cards per minute)
B-304 card punch (300 cards per minute)
B-321 high-speed printer
(No magnetic tape units, disk, or drum at the present time)

IBM-EAM Equipment

2 collators
3 sorters
1 interpreter
5 card punches
4 verifiers

General Electric GE-225 Computer

Central processor with 8K word core memory
D225B card reader (400 cards per minute)
E225K card punch (100 cards per minute)
P225A high-speed printer (900 lines per minute)
MTH 680 tape units (4)
Benson-Lehner Model J x-y plotter
MTC 680 tape controller

2. COSTS AND TIME

Permuted index system development took the Librarian 16 man-hours. Computer support costs are charged as overhead. No separate listings for program development were available. The following are

are projected estimated costs for the planned permuted index system, based on 5,000 items and using a three-card system. (Total card volume is approximately 17,500 punched cards.)

Punch Tape Typewriter

Time:	200 hours	\$ 500.00
Cost:	personnel--\$3.50/hr	\$ 700.00
		<u>\$1,200.00</u>

Converter (tape-to-punchcard)

Time:	44 hours	\$ 20.24
Cost:	machine--\$0.46/hr	\$ 154.00
	operator--\$3.50/hr	<u>\$ 174.24</u>

Card Sorter

Time:	7 hours	\$ 4.76
Cost:	machine--\$0.68/hr	\$ 24.50
	operator--\$3.50/hr	<u>\$ 29.26</u>

B-280 Computer

Time:	1 hour	\$ 20.12
Cost:	machine--\$20.12/hr	\$ 5.00
	operator--\$ 5.00/hr	<u>\$ 25.12</u>

GE 225 Computer

Time:	5.5 hours	\$ 220.00
Cost:	machine--\$40.00/hr	\$ 55.00
	operator--\$10.00/hr	<u>\$ 275.00</u>

Materials

paper punch tape--2 rolls at \$1.35/roll	\$ 2.70
punch cards--17,500 at \$1.05/M	18.40
magnetic tape--2 rolls at \$28.50/roll	57.00
4-part print paper--250 pages at \$0.05/page	12.50
1-part plain paper--450 pages at \$0.01/page	4.50
	<hr/>
	\$ 95.10
Total	<u>\$1,798.72</u>

It is estimated that monthly updating of the permuted index system will require about the same computer time as was required for the initial run.

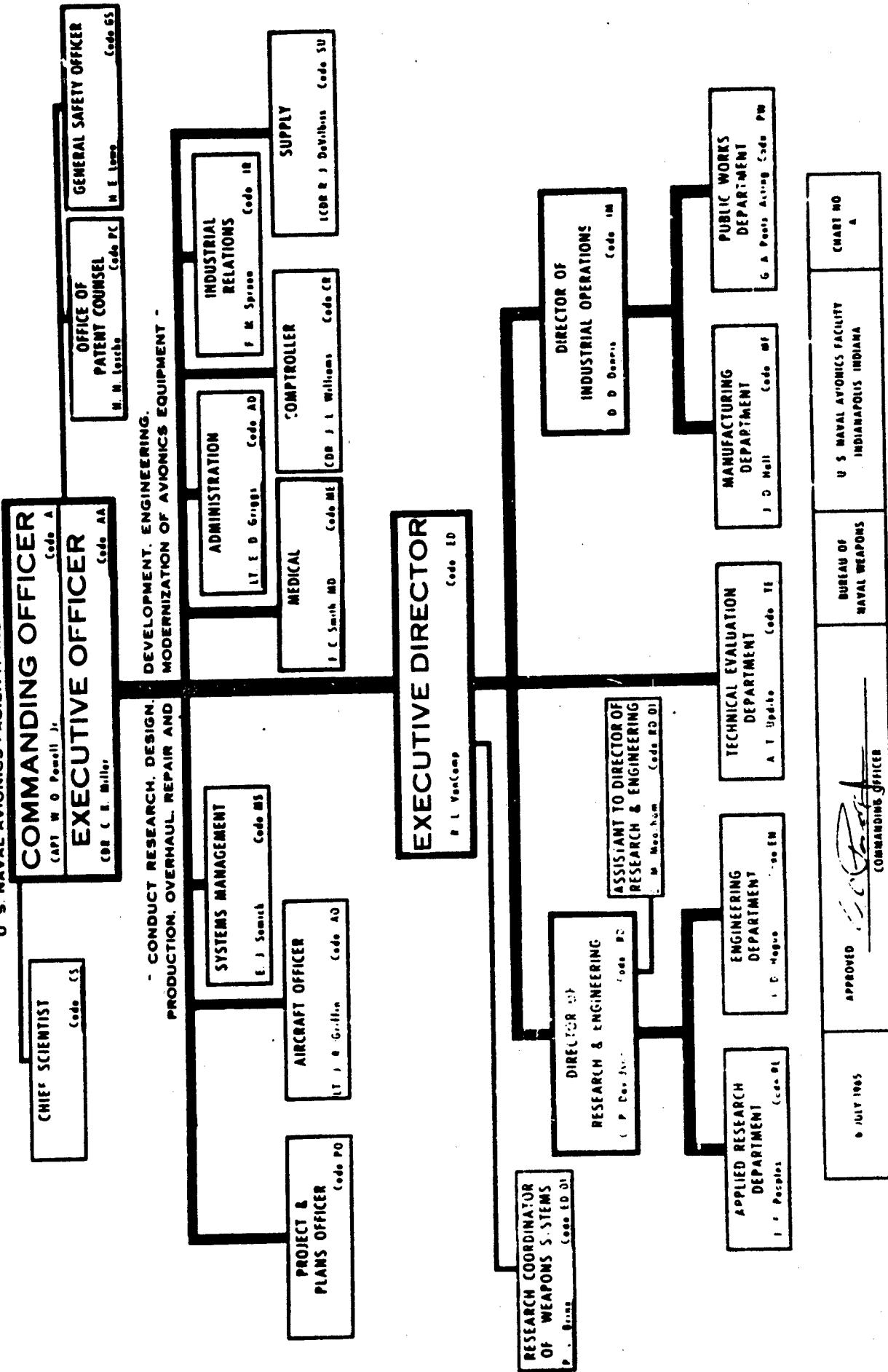
3. FACILITY'S EVALUATION OF SYSTEM

The Librarian feels that the permuted index system represents a relatively simple and inexpensive approach to mechanizing the Library's files. She recognizes that the introduction of the system would not materially reduce the clerical burden--in fact, may increase it due to the new need to "enrich" titles with keywords. However, this difficulty may be offset by the improved index coverage of particularly poorly indexed items such as proceedings of technical meetings. It would also make it possible for the users to accomplish some of their own bibliographic searching. Thus, the main goal of the system, according to the Librarian, would be to present "the researching individual (user) with all like-type subject matter information in one location for the speediest possible information retrieval."

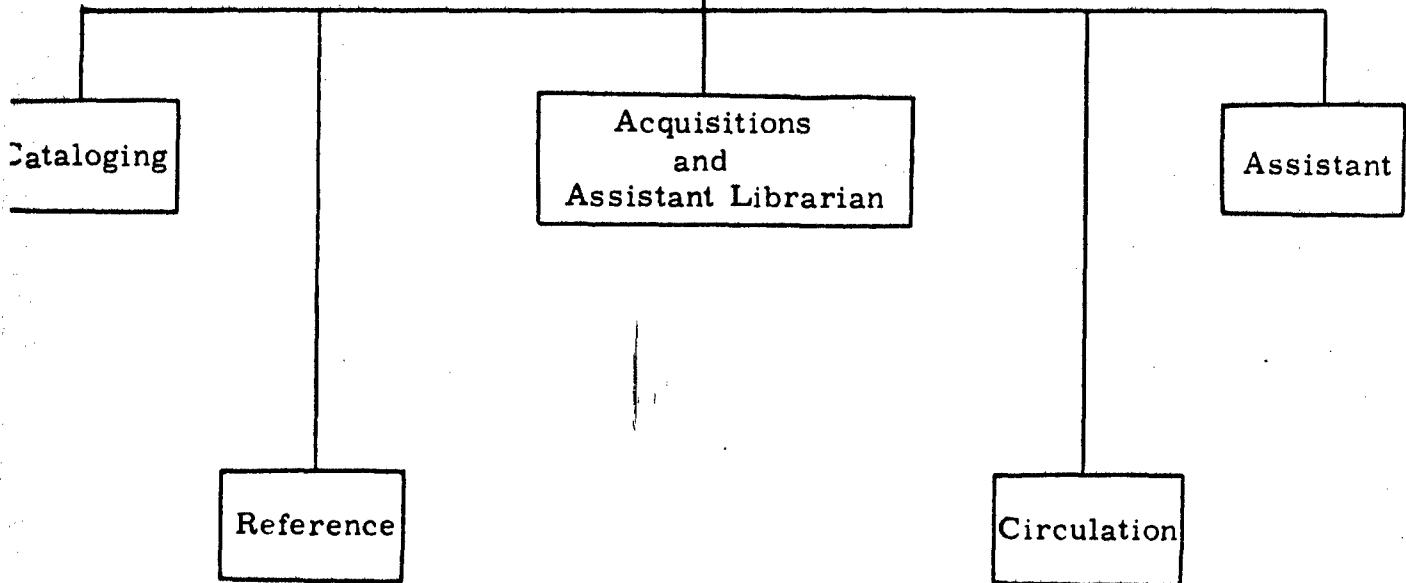
The decision to proceed with the permuted index system has not yet been made, pending further study of alternate systems and systems which will assist the Library in areas other than index development. However, the economies arising from the fact that the permuted index system is essentially developed and uses an existing program may result in a decision to use this system.

The permuted index system presently provides for using a Flexowriter to prepare tapes and to convert the tapes to punched cards. It is now believed more efficient to have the Library punch the cards directly or to prepare source document work sheets from which cards could be punched by regular keypunch operators.

U. S. NAVAL AVIONICS FACILITY, INDIANAPOLIS, INDIANA

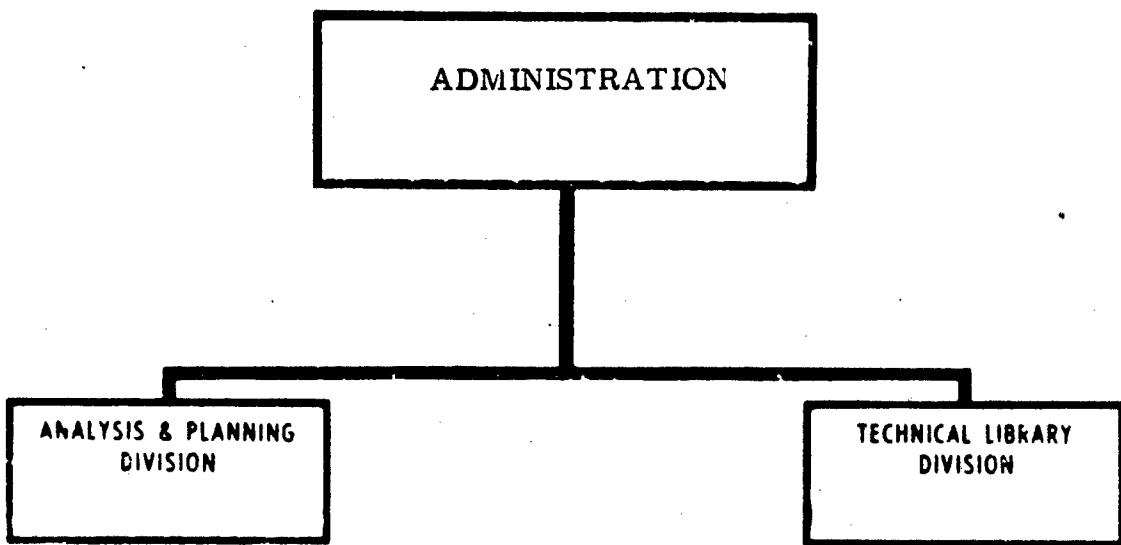


Technical Library Division
Librarian



A-2

Organization of the Library



106435 NASATECHBRIEF 01
NEW LOW-LEVEL A-C AMPLIFIER PROVIDES ADJUSTABLE NOISE-CANCELLATION
AND AUTOMATIC TEMP COMPENSATION. ELECTROCARDIOGRAPH BIOMEDICINE
NASA TECH BRIEF 63-10003 0364 NASA

AJ8157 MUELLER LI 01
INTRODUCTION TO SATELLITE GEODESY.
FREDERICK UNIQUAR PUB CO INC NEW YORK 1964 415

KS5431 MURRAY WD 02
TELEMETERING EQUIPMENTS UTILIZING TRANSISTOR-MAGNETIC CIRCUITRY AND
HIGH-DENSITY PACKAGING.
CONVENTION RECORD 1ST NATL CONV ON MIL ELECTRONICS 0664 85-87

KS5431 ROSENBERG JD 03
DIAMOND ORDNANCE FUZE LAB
RUGGED WIDE-BAND MAGNETIC TAPE RECORDER.
CONVENTION RECORD 1ST NATL MIL CONV ON ELECTRONICS 0664 143-47

SAMPLE COMPREHENSIVE BIBLIOGRAPHY

106435 NEW LOW-LEVEL A-C AMPLIFIER PROVIDES ADJUSTABLE NOISE-CANCELLATION AND AUTOMATION.

106435 A-C AMPLIFIER PROVIDES ADJUSTABLE NOISE-CANCELLATION AND AUTOMATION.

106435 NEW LOW-LEVEL A-C AMPLIFIER PROVIDES ADJUSTABLE NOISE-CANCELLATION AND AUTOMATION.

106435 ON-A ELECTROCARDIOGRAPH BIOMEDICINE

K55431 NEW TRANSISTOR-MAGNETIC CIRCUITRY AND HIGH-DENSITY PACKAGING.

106435 TIC TEMP COMPENSATION. ELECTROCARDIOGRAPH BIOMEDICINE TELEMETERING EQUIPMENTS UTILIZING TRANSISTOR-MAGNETIC C1

AJ8157 INTRODUCTION TO SATELLITE GEODESY.

K55431 MAGNETIC CIRCUITRY AND HIGH-DENSITY PACKAGING.

106435 NEW LOW-LEVEL A-C AMPLIFIER PROVIDES ADJUSTABLE NOISE-CANCELLATION AND AUTOMATION.

106435 NEW LOW-LEVEL A-C AMPLIFIER PROVIDES ADJUSTABLE NOISE-CANCELLATION AND AUTOMATION.

K55431 INTRODUCTION TO SATELLITE GEODESY.

K55431 IDE-BAND MAGNETIC TAPE RECORDER.

AJ8157 INTRODUCTION TO SATELLITE GEODESY.

K55431 GED WIDE-BAND MAGNETIC TAPE RECORDER.

K55431 TELEMETERING EQUIPMENTS UTILIZING TRANSISTORS TO 106435 ELLATION AND AUTOMATIC TEMP COMPENSATION. ELECTROCARDIOGRAPH BIOMECHANICAL TRANSISTOR-MAGNETIC CIRCUITRY AND HIGH-DENSITY

K55431

RUGGED WIDE-BAND MAGNETIC TAPE RECORDER.

SAMPLE PERMUTED INDEX

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Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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INSTRUCTIONS						
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